



DEVELOPMENT OF GUIDED INQUIRY BASED LEARNING DEVICES TO IMPROVE STUDENT LEARNING OUTCOMES IN SCIENCE MATERIALS IN MIDDLE SCHOOL

Ade Budhi Rahayu¹,
Sutarto Hadi,
Maya Istyadji,
Muhammad Zaini,
Arif Sholahuddin,
Fahmi

Master Program of Natural Science Teacher,
Lambung Mangkurat University,
Banjarmasin, Indonesia

Abstract:

The quality of education in Indonesia is still low based on data from international studies, namely the education development index shows that Indonesia has not moved from the medium or medium category, especially in the field of science. This fact assumes science learning as a problematic learning content. This study aims to develop a learning device that is able to overcome these problems on a local scale. This study uses the Design of Educational Research and its development model uses the Dick and Carey approach. The subjects used in the one-to-one test amounted to 3 people, the small group test amounted to 14 people, and the test of a large group of 60 class VII SMP students with a testing area in Banjarbaru. Learning outcomes show improvement in both the experiment and the control class with an increase category at the moderate level. Data shows normal distribution and both classes are considered homogeneous and the t-test shows that there is a significant influence between the use of guided inquiry models compared to conventional learning using developed tools.

Keywords: development of learning tools, guided inquiry, student learning outcomes

1. Introduction

The learning system in Indonesia currently adheres to the 2013 curriculum that prepares students who are competitive, productive, creative, innovative, and affective who are good and contribute to society. The purpose of learning is to obtain behavioral learning outcomes that are expected. Slavin (2000) defines learning goals as the

¹ Correspondence: email mkipaunlam@gmail.com

direction to be addressed from a series of activities carried out in the learning process. In integrated science learning, the learning objectives to be achieved are so that students can experience the whole learning process, understand natural phenomena through problem solving activities, scientific methods, and imitate the way scientists work in finding new facts (Ministry of National Education, 2010). These learning experiences are the aim of training students' science process skills (Nadziroh et al., 2018).

But the quality of education in Indonesia is still low, this can be seen from the data from international studies, the education development index for all or education for all, Indonesia has not moved from the medium or medium category. Based on the report of the United Nations Education, Science and Culture Organization (UNESCO) in 2012, Indonesia ranked 64th out of 120 countries after previously in 2011, Indonesia was ranked 69th out of 127 countries. As for the education rankings of the ASEAN region in 2017, Indonesia is ranked 5 with a score of 0.603 while Singapore is ranked 1, Brunei Darussalam 2, Malaysia 3 and Thailand is ranked 4 (DW, 2017). Likewise the results of data from Puspendik Balitbang Kemdikbud state that the results of the National Final Examination (UAN) for 2013/2014 Academic Year at the junior high school level for Banjarbaru City are ranked 10th out of 13 districts/cities in South Kalimantan province. The results of this data show that education in the city of Banjarbaru still needs to be improved both at the provincial level and at the national level. Whereas for the average science score of 7.03. This fact, shows that in general students view science lessons as an uninteresting and unpleasant lesson. The event was caused by the learning carried out in school or class was still not in accordance with the nature of science learning (Ali et al., 2013).

Learning will be more meaningful if students are given the opportunity to know and be actively involved in finding concepts from existing phenomena from the environment with the guidance of teachers (Fahmi and Irhasyuarna, 2017). If science learning is not taught according to the nature of science learning, learning outcomes will not be optimal (Johari, 2014). Learning is the process of interaction between students and teachers and learning resources in a learning environment, so to realize the goals of science learning in schools, science teachers should understand the nature of science, be able to become facilitators of learning in accordance with the abilities and needs of students as designed in the curriculum (Ali et al., 2013).

The nature of science learning has three components, namely the product component, process and attitude. Science as a product means a set of facts, concepts, principles and laws about natural phenomena. Science as a process is a series of structural and systematic tests carried out to find concepts, principles, laws and natural phenomena. While science as an attitude is expected to be able to shape character. So that it is clear that what is desired in science learning is that students are able to behave and be able to show their character (Suastra, 2009). One of the learning models in order to achieve these objectives is guided inquiry learning. Because in the guiding principle of implementing the curriculum in learning is to use a contextual approach to the strengthening process using a scientific (scientific) approach and authentic assessment

that uses the principle of assessment part of learning. The scientific approach to learning can be applied using the Discovery/Inquiry learning model (Permendikbud Number 58 of 2014 concerning Standard and Middle Education Process Standards). The use of guided inquiry is due to the intellectual development of students at middle school age according to Piaget at the formal operational level. That is, in this period children have been able to think logically, think with formal theoretical thinking based on propositions and hypothesize. To achieve these objectives the role of the teacher is needed in learning (Rizal, 2014).

Guided inquiry learning is considered appropriate to be used for seventh grade students of SMP, because the characteristics of class VII junior high school students who are still not fully able to learn self-directed, the level of cognitive development of students in the intermediate stage from concrete operations to formal operations. Still needing the teacher as a guide so students are able to reflect on the learning experience. Guided inquiry is a learning activity that places the teacher to determine the topic and motivates students to arise questions in the minds of students then students are tasked with formulating hypothetical problems, working procedures, analyzing data and concluding it but still under teacher guidance.

According to Towndrow and Ling (2008), inquiry is learning that does not only use methods of remembering facts but must also include planting the application of knowledge to students. The advantages of guided inquiry learning methods are: (1) Encouraging students to think and formulate their own hypotheses, (2) Encourage students to think and work on their own initiative, (3) Teaching becomes more student-centered, (4) Students can form and develop concepts own. So inquiry really supports the theory of constructivism in its implications (Roestiyah, 2001). The research results of Rahmawati (2012) concluded that learning using guided inquiry methods can improve learning abilities, namely by making students more active in the learning process so that they can also increase student activity in thinking, so as to improve student learning outcomes.

Learning outcomes are a series of mental body activities to obtain a change in behavior as a result of the experience of individuals interacting with their environment concerning cognitive, affective and psikomotor. The learning outcomes in the form of affective and psikomotor one of which is the ability of science process skills of students (Djamarah, 2002).

Improving the scientific performance of students through learning activities that are able to improve their process skills and scientific attitudes, which will later lead to the creation of long-term concepts in the memory of students (Fahmi and Irhasyurna, 2017). Students with high scientific performance will certainly be able to shape their own knowledge. This is in line with the principle of constructivism, that students are actively constructing their knowledge. So, the teacher does not need to worry about lack of time to complete the material that is the demand of the curriculum, because with the scientific performance that is owned, students are able to build their own knowledge, which will lead to improving student learning outcomes (Setiadi and Irhasyurna,

2017). Learning is not only limited to the place and fixated on the teacher in the school, because with the increase in scientific performance, students can explore knowledge anywhere.

Science subjects in junior high school are one of integrated learning. Integrated learning is learning that begins with a particular subject or theme that is related to another subject, certain concepts are associated with other concepts, which are applied spontaneously or planned, either in one field of study or more, with a variety of children's learning experiences, so that learning become more meaningful. But in the implementation in the field it has not been realized perfectly, where the delivery of material to students is still separately between physical, biological, chemical and IPBA material. The low scientific performance of students reflects the low motivation of students to learn science (Dewi, 2013). There are a number of things that have become difficulties in implementing integrated science in junior high schools, among others: 1) teacher readiness, so far science teachers from disciplinary backgrounds are indeed separate from physics, biology and chemistry, 2) difficulty integrating science concepts into integrated learning, 3) there are still a few printed textbooks that contain science concepts in an integrated manner. Based on the inhibiting factors in the application of science, try to overcome by making a learning tool that can train students' process skills and improve learning outcomes and apply them in the field. These results will be seen how much the success of Integrated Science learning with a contextual approach to the strengthening process using a scientific (scientific) approach and authentic assessment that uses the principle of evaluating part of learning requires an innovative planning, implementation and assessment.

In the process, the steps taken when developing the device are: a) identifying learning objectives, b) conducting in-depth learning analysis, c) identifying student characteristics, d) formulating specific learning objectives, e) developing test items, f) developing strategies learning, g) developing and selecting learning tools, h) designing and implementing formative evaluations, and i) revising learning. All development steps are based on the Dick and Carey model approach so that the process runs systematic and hierarchical in order to achieve the research objectives. Considerations in choosing the Dick and Carey models, (1) Dick and Carey's theoretical basis are goal-oriented, condition variables, and results are used to establish optimal learning methods (Reigulut, 1983), (2) can be used to design learning materials, both for the need to study both classical and individual classes, (3) can be used to develop learning materials in the intellectual realm, attitudes, skills, and verbal information, and (4) the Dick and Carey models show a very clear, concise, unbroken relationship between step one step with the other.

2. Methods

This study uses the Design of Educational Research. This study resulted in the form of a learning tool and the results of its application in the classroom using a guided inquiry

based learning model. Learning tools to be developed in this study are Syllabus, lesson plans, teaching materials, LKPD, and learning outcomes tests where the research instruments are in the form of assessment instruments (lesson plans, teaching materials, LKPD, readability of teaching materials and LKPD, assessment sheet validation instruments, observation sheet instruments) (implementation of teacher and student activities), learning outcomes test instruments, science process skills, character attitude assessment instruments, social attitude assessment instruments, psychomotor skills assessment instruments. The development model uses the Dick and Carey Model approach. Subjects used in the one test -to-one numbered 3 people, a small group test of 14 people, and a large group of 60 people from Class VII of a junior high school in Banjarbaru.

3. Results and Discussion

The device was made to adjust the 2013 curriculum and continued to be revised to adjust needs in the classroom. Its development is assessed by validators and observations that are considered experts in their fields. Based on the results of the validation test that has fulfilled the valid elements used in the learning together with a one-to-one trial and a draft II device. Draft device II was applied in small groups and analyzed the progress of learning through teacher activities and student activities. Teachers are considered capable of managing learning well using the developed tools. The same is true for students who are considered good when applied to devices developed by researchers. This condition illustrates the effectiveness of expectations achieved. The device was revised to draft III devices before becoming the final device.

In the field test assessed the progress of students towards the application of learning devices. First, learning outcomes during learning are assessed in Table 1.

Table 1: Field Test Data

Class	Score	Completeness	Score	Completeness	Gain	N=gain	Increase Category
	Pretest		Posttest				
Experiment	68.67	46.67%	83.17	90.00%	14.50	0.51	Moderate
Control	64.40	30.00%	76.03	70.00%	11.63	0.34	Moderate
Category: High G = g value $\geq 0,70$, Medium G = g value $0,30 \leq g < 0,70$, Low G = g value $\leq 0,30$							

The average difference test is used to determine the differences in cognitive learning outcomes of experimental class students taught by guided inquiry methods and control classes taught by conventional methods. The different test steps for the two samples (two sample t-test) are as follows.

3.1 Normality Test

The data normality test aims to find out whether the data comes from the normal distribution population. To test normality is to use the help of SPSS version 22.00 software with $\alpha = 5\%$ and the results can be seen in Table 2 below.

Table 2: Normality Test of Post-Test Data of Experimental Class and Control Class

	Kolmogorov-Smirnov ^a		
	Statistic	df	Sig.
Experiment	0.106	30	0.200
Control	0.102	30	0.200
a. Lilliefors Significance Correction			

Based on the table above, it is known that the results of the posttest normative data of the experimental class obtained a significant value of 0.200 while the control class was 0.200. That is, the significance value of the experimental and control class data is more than 5%, which means that the experimental class and control post-test data are normally distributed.

3.2 Homogeneity Test (Variant Similarity Test)

The homogeneity test was carried out to obtain the assumption that the study sample originated from a homogeneous condition. To test homogeneity is to use SPSS software version 22.00 with $\alpha = 5\%$ and the results can be seen in table 3 below.

Table 3: Homogeneity Test Results

Levene's Test for Equality of Variances	
F	Sig.
1.068	0.306

Based on the table above, there is a significant level of 0.306 or more than 5%, which means there is no difference in data variance between classes using a guided inquiry model with conventional learning, meaning both classes are homogeneous.

3.2 Independent Sample t-Test

Testing the difference in the average test of mathematical communication skills between students with guided inquiry model learning and control class with conventional learning is done to determine whether the use of a guided inquiry model will produce better values or not.

Hypothesis:

$H_0: \mu_1 \leq \mu_2$ (class average value using a guided inquiry model less than or equal to the class average value with conventional learning)

$H_1: \mu_1 > \mu_2$ (the average value of class learning outcomes using the guided inquiry model model is more than the class average value with conventional learning)

Average difference test, calculated by t test. The results of t-test calculations can be presented in Table 4 below.

Table 4: The Calculation Results Independent Sample t-Test

Class	N	Mean	t value
Experiment	30	83,16	2,988
Control	30	76,03	

Based on Table 4 above, it can be seen that the value of t count is obtained at 2.988. The value of t table for $db = (n_1 + n_2 - 2) = (30 + 30 - 2) = 58$ with a significance level of 5% is known as 2,002. Because the value of t count = 2.988 > t table = 2.002, it was decided to reject H_0 and accept H_1 . That is, the average value in the class treated with the guided inquiry model is greater than the class average value with conventional learning. This indicates that there is a significant influence between the use of inquiry and conventional learning models on the application of learning devices.

Bilgin (2009) concluded that the results were significantly better in understanding the science concept for the experimental class using a guided inquiry model than in the control class with traditional learning. Some other studies also state the same, among others, according to Berry & Berry (2014) learning using inquiry models can increase engagement and produce meaningful learning, according to Martin & Hansen (2002) the use of guided inquiry in the investigation process requires guidance from the teacher to solve problems. This finding was supported by Dewi, et al. (2013) which states through a guided inquiry model that students are guided to know knowledge through direct experience.

During the learning process also observed and assessed character skills in students. Natural Science Learning (IPA) cannot be separated from character development. The Law of the Republic of Indonesia number 20 of 2003 concerning the National Education System is the basis for the integration of character education into teaching materials as a support for learning facilities. In order for these characters to be manifested in a person, habituation in daily life is needed, both through home education and school education, which is called character education. In simple character education is everything we do intentionally that affects the character of the children we teach.

The principle used in the development of cultural education and national character must be in accordance with what was stated by MONE (2010), namely sustainable, through all subjects, values are developed, and carried out actively and pleasantly. So with this principle, students can learn through the process of thinking, behaving, and acting. In this study character behaviors that are integrated in learning devices have 4 indicators, namely (1) sense of gratitude, (2) honesty, (3) responsibility, and (4) discipline. In testing the effectiveness of the device and to find out whether or not the revision of the learning device developed character traits in the small group test is also a measure in the assessment, based on the observation table of character behavior in the small group test, for indicators of sense, honesty, responsibility and discipline at 4 face-to-face meetings shows an average of 98% with very good categories. Thus it can be concluded that the learning device developed with the guided inquiry model has been able to bring up the character traits of students with characteristic behavioral attitudes that can be observed, namely in the behavior of gratitude, honesty, responsibility and discipline.

Whereas based on the characteristic behavior observation table in field trial 1, indicators of sense, honesty, responsibility, and discipline at 4 face-to-face meetings

showed an average of 95% with a very good category. Thus it can be concluded that the learning device developed with the guided inquiry model has been able to bring up the character traits of students with characteristic behavioral attitudes that can be observed, namely in the behavior of gratitude, honesty, responsibility and discipline. Character behavior in the field test for indicators of sense of sincerity, honesty, responsibility, and discipline in 4 face-to-face meetings with very good categories. Thus it can be concluded that the learning device developed with the guided inquiry model has been able to bring up the character traits of students with characteristic behavioral attitudes that can be observed, namely gratitude, honesty, responsibility and discipline.

4. Conclusion

This study aims to produce learning devices and their implementation towards guided inquiry based learning models. The observation results of the teacher's ability in learning activities developed during learning using the developed tools show the achievement of each step of the learning activity. The results of the observation of the teacher's activity showed that the implementation of the lesson plan in the field test was 96.6% where each face to face had a reliability of more than 75%, so the device could be categorized as good. From these results it can be concluded that the device is developed practically, and can be used well by researchers and other teachers. Validators assess the device to meet validity to use. Improvement in cognitive skills is at a moderate level for the experimental and control classes. Whereas in the different test, there is a significant influence on the use of guided inquiry learning models when implemented learning devices developed.

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